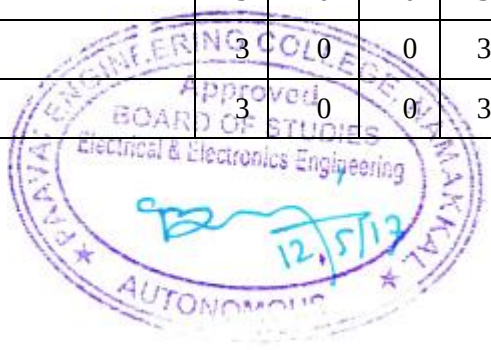
PAAVAI ENGINEERING COLLEGE(AUTONOMOUS)

REGULATIONS – 2016
PG CURRICULUM
CHOICE BASED CREDIT SYSTEM
(For the candidate's admitted during the academic year 2016-2017)

M.E.- POWER SYSTEMS ENGINEERING						
SEMESTER III						
Theory						
1	PPS1645*	Elective IV	3	0	0	4
2	PPS1655*	Elective V	3	0	0	3
3	PP*1665*	Elective VI	3	0	0	3
Practical						
4	PPS16301	Project Work (Phase I)	0	0	12	6
		TOTAL	**9**	**0**	**12**	**16**
SEMESTER IV						
Practical						
1	PPS16401	Project Work (Phase II)	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**
LIST OF ELECTIVES						
ELECTIVE IV						
1	PPS16451	Deregulation of Power System	3	0	0	3
2	PPS16452	Distributed Generation and Micro grid	3	0	0	3
3	PPS16453	Industrial Power System Analysis and Design	3	0	0	3
ELECTIVE V						
1	PPS16551	Advanced Power System Dynamics	3	0	0	3
2	PPS16552	Smart Grid Design and Analysis	3	0	0	3
3	PPS16553	Computer Aided Power Systems Analysis	3	0	0	3
ELECTIVE VI						
1	PPS16651	Applications of MEMS Technology	3	0	0	3
2	PPE16652	VLSI Design Techniques	3	0	0	3
3	PPE16653	Virtual Instrumentation Systems	3	0	0	3



ELECTIVE IV

PPS16451 DEREGULATION OF POWER SYSTEMS 3 0 0 3

COURSE OBJECTIVES

- To discuss the restructuring of power industry and market models based on Contractual arrangements
- To infer knowledge on fundamental concepts of congestion management.
- To analyse the concepts of locational marginal pricing and financial transmission rights.
- To understand marginal transmission pricing paradigm and pricing of transmission network.
- To explain the availability based tariff and framework of Indian power sector.

UNIT I INTRODUCTION TO RESTRUCTURING OF POWER INDUSTRY 9

Introduction: Deregulation of power industry, Restructuring process, Issues involved in deregulation, Deregulation of various power systems – Fundamentals of Economics: Consumer behavior, Supplier behavior, Market equilibrium, Short and long run costs, Various costs of production – Market models: Market models basedon Contractual arrangements, Comparison of various market models, Electricity vis – a – vis other commodities, Market architecture, Case study.

UNIT II TRANSMISSION CONGESTION MANAGEMENT 9

Introduction: Definition of Congestion, reasons for transfer capability limitation, Importance of congestion management, Features of congestion management – Classification of congestion management methods – Calculation of ATC - Non – market methods – Market methods – Nodal pricing – Inter zonal and Intra zonal congestion management – Price area congestion management – Capacity alleviation method.

UNIT III LOCATIONAL MARGINAL PRICES AND FINANCIAL TRANSMISSION RIGHTS 9

Mathematical preliminaries: -Locational marginal pricing– Lossless DCOPF model for LMP calculation – Loss compensated DCOPF model for LMP calculation – ACOPF model for LMP calculation – Financial Transmission rights – Risk hedging functionality - Simultaneous feasibility test and revenue adequency – FTR issuance process: FTR auction, FTR allocation – Treatment of revenue shortfall – Secondary trading of FTRs – Flow gate rights – FTR and market power - FTR and merchant transmission investment.

UNIT IV ANCILLARY SERVICE MANAGEMENT AND PRICING OF TRANSMISSION NETWORK 9

Introduction of ancillary services – Types of Ancillary services – Classification of Ancillary services – Load generation balancing related services – Voltage control and reactive power support devices – Black start capability service - ancillary service –Co-optimization of energy and reserve services - International comparison - Transmission pricing – Principles – Classification – Role in transmission pricing methods – Marginal transmission pricing paradigm – Composite pricing paradigm – Merits and demerits of different paradigm.

UNIT V REFORMS IN INDIAN POWER SECTOR 15

Introduction – Framework of Indian power sector – Reform initiatives - Availability based tariff – Electricity act 2003 – Open access issues – Power exchange – Reforms in the near future.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- understand the restructuring of power industry and market models based on Contractual arrangements.
- use the knowledge on fundamental concepts of congestion management.
- analyze the operation of central processing and arithmetic logic units.
- demonstrate the availability based tariff.
- framing of Indian power sector.

REFERENCES

1. Mohammad Shahidehpour, MuwaffaqAlomoush, Marcel Dekker, "Restructured electrical power systems: operation, trading and volatility" Pub., 2001.
2. Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, "Operation of restructured power systems", Kluwer Academic Pub., 2001
3. Sally Hunt, "Making competition work in electricity", John Willey and Sons Inc. 2002.
4. Steven Stoft, "Power system economics: designing markets for electricity", John Wiley & Sons, 2002

WEB LINKS

1. www.springer.com/cda/content/.../cda.../9781852336707-c1.pdf
2. www.powershow.com/.../Deregulation_as_a_Power_Engineering_Course.
3. www.powerworld.com/files/tjo_sum99_market.ppt

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	Programme Outcomes PO's												PSO's	
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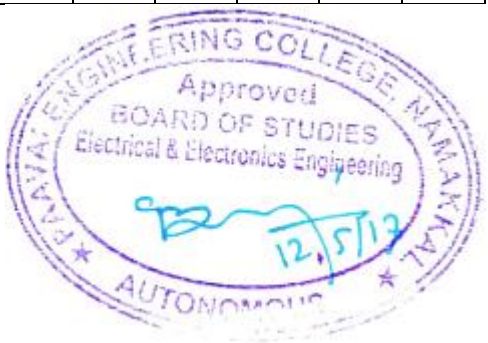

PPS16452 DISTRIBUTED GENERATION AND MICROGRID 3 0 0 3

COURSE OBJECTIVES

- To understand Conventional power generation
- To analyze interconnecting distributed resources to electric power systems.
- To point out the impact of grid integration with NCE sources on existing power system.
- To study concept and definitions of Micro grid and its configuration.
- To produce knowledge on various power quality issues in micro grids.

UNIT I INTRODUCTION 9

Conventional power generation: Advantages and disadvantages, Energy crises, Non-Conventional Energy (NCE) resources: Review of Solar PV, Wind Energy systems, Fuel Cells, Micro-turbines, Biomass, and Tidal sources.

UNIT II DISTRIBUTED GENERATIONS (DG) 9

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547.DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants

UNIT III GRID INTEGRATION IN DG 9

Requirements for grid interconnection, limits on operational parameters: Voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues

UNIT IV MICROGRIDS 10

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids, communication infrastructure, modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes.

UNIT V POWER QUALITY ISSUES IN MICROGRIDS 8

Power quality issues in micro grids- Modeling and Stability analysis of Microgrid, regulatory standards, Microgrid economics, Introduction to smart micro grids

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- apply the basic concept of distributed generation.
- summarize the interconnecting Distributed resources to electric power systems.
- analyze the impact of grid integration with NCE sources on existing power system.
- study the concepts and definitions of Microgrid and its configuration.
- demonstrate the availability based tariff and framework of Indian power sector.

REFERENCES

1. AmirnaserYezdani, and Reza Iravani, "Voltage Source Converters in Power Systems: Modeling, Control and Applications", IEEE John Wiley Publications, 2009.
2. DorinNeacsu, "Power Switching Converters: Medium and High Power", CRC Press, Taylor & Francis, 2006
3. Chetan Singh Solanki, "Solar Photo Voltaics", PHI learning Pvt. Ltd., New Delhi, 2009.
4. J.F. Manwell, "Wind Energy Explained, theory design and applications," J.G. McGowan Wiley publication, 2002.
5. D. D. Hall and R. P. Grover, "Biomass Regenerable Energy", John Wiley, New York, 1987.
6. John Twidell and Tony Weir, "Renewable Energy Resources" Tyalor and Francis Publications, 2005.

WEB LINKS

1. nptel.ac.in/courses/108108034/
2. www.egr.msu.edu/~mitraj/misc/Mitra_seminar_LANL.pdf
3. https://www.ee.iitb.ac.in/wiki/faculty/sak

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PPS16453 INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN 3 0 0 3

COURSE OBJECTIVES

- To study about motor starting methods
- To analyze the harmonic sources.
- To design the harmonic filters.
- To understand the flicker analysis and case study.
- To know about ground grid analysis.

UNIT I MOTOR STARTING STUDIES 9

Introduction-Evaluation Criteria-Starting Methods-System Data-Voltage Drop Calculations-Calculation of Acceleration time-Motor Starting with Limited-Capacity Generators Computer-Aided Analysis-Conclusions.

UNIT II POWER FACTOR CORRECTION STUDIES 9

Introduction-System Description and Modeling-Acceptance Criteria-Frequency Scan Analysis-Voltage Magnification Analysis-Sustained Overvoltage‟s-Switching Surge Analysis-Back-to-Back Switching-Summary and Conclusions

UNIT III HARMONIC ANALYSIS 9

Harmonic Sources-System Response to Harmonics-System Model for Computer-Aided Analysis-Acceptance Criteria-Harmonic Filters-Harmonic Evaluation-Case Study- Summary and Conclusions.

UNIT IV FLICKER ANALYSIS 9

Sources of Flicker-Flicker Analysis-Flicker Criteria-Data for Flicker analysis- Case Study- Arc Furnace Load-Minimizing the Flicker Effects-Summary.

UNIT V GROUND GRID ANALYSIS 9

Introduction-Acceptance Criteria-Ground Grid Calculations-Computer-Aided Analysis - Improving the Performance of the Grounding Grids-Conclusions.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- demonstrate the motor starting techniques.
- demonstrate the power factor correction techniques
- determine the level of harmonics and its effect.
- analysis the flickers and methods of minimizing its effects.
- explain about ground grid analysis

REFERENCES

1. Ramasamy Natarajan, ”Computer-Aided Power System Analysis”, Marcel DekkerInc., 2002.
2. J. Duncan Glover, MulukutlaS.Sarma, Thomas Overbye, “Power System Analysis and Design”, 2011.
3. Patrick H Garrett,” High performance Instrumentation and Automation”, CRC Press, Taylor & Francis Group, 2005.

4. TuranGonen “Electrical Power Transmission System Engineering: Analysis and Design”, Mcgraw Hill publishers,2008.
5. RamasamyNatarajan, “Computer-Aided Power System Analysis”, Marcel Dekker Inc., 2012.
6. P. Kundur, “Power System Stability and Control”, McGraw-Hill, 2008.

WEB LINKS

1. www.unge.gq/ftp/biblioteca%20digital/.../Estabilidad%20-%20kundur.p...
2. books.google.com › ... › Power Resources › Electrical
3. www.infibeam.com/.../high-performance-instrumentation-automation-patri...
4. www.gbv.de/dms/ilmenau/toc/593623495.PDF

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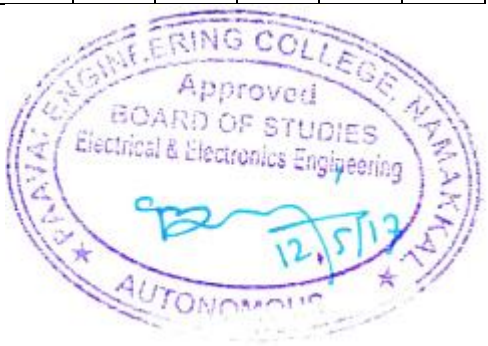

ELECTIVE V

PPS16551 ADVANCED POWER SYSTEM DYNAMICS 3 0 0 3

COURSE OBJECTIVES

- To apply transient stability analysis using unified algorithm.
- To describe knowledge on sub-synchronous resonance and oscillations.
- To analyze the mathematical model of the synchronous machine to analyze it under stationary and transient conditions.
- To describe the transient stability problems and to protect the system against stability problems.
- To infer knowledge on voltage stability problems by applying transient stability enhancement methods.

UNIT I TRANSIENT STABILITY ANALYSIS 9

Review of numerical integration methods: Euler and Fourth Order Runge-Kutta methods, Numerical stability and implicit methods, Simulation of Power System Dynamic response: Structure of Power system Model, Synchronous machine representation: equations of motion, rotor circuit equations, stator voltage equations, Thevenin's and Norton's equivalent circuits, Excitation system representation, Transmission network and load representation, Overall system equations and their solution

UNIT II SUBSYNCHRONOUS OSCILLATIONS 9

Introduction – Turbine Generator Torsional Characteristics: Shaft system model – Examples of torsional characteristics – Torsional Interaction with Power System Controls: Interaction with generator excitation controls – Interaction with speed governors – Interaction with nearby DC converters.

UNIT III SUBSYNCHRONOUS RESONANCE (SSR) 9

Sub synchronous Resonance (SSR): Characteristics of series –Compensated transmission systems – Self-excitation due to induction generator effect – Torsional interaction resulting in SSR – Analytical Methods – Numerical examples illustrating instability of sub synchronous oscillations – Impact of Network-Switching Disturbances: Steady-state switching – Successive network-Switching disturbances – time-domain simulation of sub synchronous resonance – EMTP with detailed synchronous machine model.

UNIT IV TRANSMISSION, GENERATION AND LOAD ASPECTS OF VOLTAGESTABILITY ANALYSIS 9

Review of transmission aspects – Generation Aspects: Review of synchronous machine theory – Voltage and frequency controllers – Limiting devices affecting voltage stability – Voltage-reactive power characteristics of synchronous generators – Capability curves – Effect of machine limitation on deliverable power – Load Aspects – Voltage dependence of loads – Load restoration dynamics – Induction motors – Load tap changers – Thermo static load recovery – General aggregate load models.

UNIT V ENHANCEMENT OF TRANSIENT STABILITY AND COUNTER MEASURES FOR SUB SYNCHRONOUS RESONANCE 9

Principle behind transient stability enhancement methods: high-speed fault clearing, reduction of transmission system reactance, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast-valving, high-speed excitation systems; NGH damper scheme.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- apply numerical integration methods to analyze transient stability.
- understand Torsional Interaction with Power System Controls
- solve Switching Disturbances in Sub synchronous resonance
- analyze voltage stability in Transmission, generation and load aspects
- understand and apply various transient stability enhancement methods

REFERENCES

1. P. Kundur, Power System Stability and Control, McGraw-Hill, 1993.
2. Narendra and Annasamy," Stable Adaptive Control Systems, Prentice Hall, 1989.
3. H. W. Dommel, EMTP THEORY BOOK, Microtran Power System Analysis Corporation, Second Edition, 1996.

WEB LINKS

1. http://nptel.ac.in/courses/108101004/
2. www.nptelvideos.in/2012/11/power-system-dynamics.
3. www.cdeep.iitb.ac.in/NPTEL2/video_courses

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CO5	3	-	3	2	3	1	-	1	-	2	-	2	2	3

PPS16552 SMART GRID DESIGN AND ANALYSIS 3 0 0 3

COURSE OBJECTIVES

- To produce a comprehensive understanding on design and analysis of smart grids
- To understand the phasor measurement unit technologies in smart grid.
- To understand the wide area measurement system in smart grid.
- To apply advanced analytic tools in planning and operation of smart grids.
- To discuss the renewable energy resources and storages integrated with smart grid

UNIT I SMART GRID ARCHITECTURAL DESIGNS 9

Introduction – Comparison between existing grid and smart grid– power system enhancement – communication and standards - General View of the Smart Grid Market Drivers - Stakeholder Roles and Function - Measures - Representative Architecture - Functions of Smart Grid Components Wholesale energy market in smart grid

UNIT II PHASOR MEASUREMENT UNIT TECHNOLOGY 8

Architecture, Functions, Optimal Placement of PMUs, Phasor data concentrators and associated communication system. Visualization tools to enhance visibility and control within transmission system, PMU measurements and sampling rates State Estimation & observability by using PMU, phasor data use for real time operation, frequency stability monitoring and trending, power oscillation, voltage monitoring and trending. Alarming and setting system operating limits. Dynamic line rating and congestion management, outage restoration. Application of PMU for wide area monitoring and control.

UNIT III WIDE AREAMEASUREMENT SYSTEM 9

Architecture, Components of WAMS, GUI (Graphical User Interface), Applications: Voltage Stability Assessment, Frequency stability Assessment, Power Oscillation Assessment, Communication needs of WAMS, WAMPAC (Wide Area Monitoring Protection & Control), RAS (Remedial Action Scheme). Standards: IEEE 1344, IEEEC37.118 (2005), IEEE Standard C37.111-1999 (COMTRADE), IEC61850 GOOSE.

UNIT IV STABILITY ANALYSIS TOOLS FOR SMART GRID 10

Voltage Stability Analysis Tools-Voltage Stability Assessment Techniques-Voltage Stability Indexing- Application and Implementation Plan of Voltage Stability in smart grid- Pathway for designing smart grid- Approach of smart grid to State Estimation-Energy management in smart grid. Environmental impacts.

UNIT V SUSTAINABLE ENERGY AND GRID INTEGRATION 9

Sustainable Energy Options for the Smart Grid-Penetration and Variability Issues Associated with Sustainable Energy Technology-Demand Response Issues-Electric Vehicles and Plug-in Hybrids PHEV Technology-Environmental Implications-Storage Technologies-Grid integration issues of renewable energy sources.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- summarize the understanding on recent development of power grids.
- apply advanced analysis tools in planning and operation of smart grids
- analyze the stability of smart grid.
- demonstrate the renewable energy resources and storages integrated with smart grid.

- integrate the sustainable energy and grid integration.

REFERENCES

1. James Momoh, "Smart Grid: Fundamentals of design and analysis", John Wiley & sons Inc, IEEE press 2012.
2. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley & sons inc, 2012.
3. Fereidoon P. Sioshansi, "Smart Grid: Integrating Renewable, Distributed & Efficient Energy", Academic Press, 2012.
4. Clark W.Gellings, "The smart grid: Enabling energy efficiency and demand response", Fairmont Press Inc, 2009.
5. "Smart Grid Infrastructure & Networking", Krzysztof Iniewski, Tata McGraw-HillEdition. 2012

WEB LINKS

1. www.nptel.ac.in/courses/108108078/pdf/chap10/teach_slides10.pdf
2. www.iitk.ac.in/...2%20IITK/Smart%20Grid%20Concept%20&%20Deplo
3. nptel.ac.in/courses/102103044/pdf/mod6.pdf

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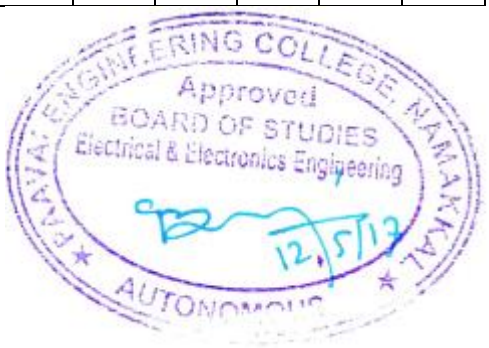

PPS16553 COMPUTER AIDED POWER SYSTEMS ANALYSIS 3 0 0 3

COURSE OBJECTIVES

- To know power flow analysis using matrix method.
- To learn the basic concepts to analyze the faults in power system.
- To understanding the stability analysis in power system.
- To design the matrix for port networks and power flow problems.
- To study the computer aided power flow analysis.

UNIT I INTRODUCTION TO AC POWER FLOW ANALYSIS 9

Introduction, Review of Fundamentals, Types of power system analysis, Modeling of power system components, Basic Matrix Algebra, Formation of Y_{bus} Matrix, Power Flow Solution Algorithms, Newton Raphson Load Flow Method, AC-DC System Power Flow Analysis- Sequential and Simultaneous Solution Algorithms.

UNIT II FAULT ANALYSIS IN POWER SYSTEM 9

Analysis of Symmetrical and Unsymmetrical Faults, Shunt Faults, Series Faults, Formation of Z_{bus} Matrix Short Circuit Analysis of Large Power Systems using Z_{bus}, Analysis of Open Circuit faults.

UNIT III STABILITY ANALYSIS IN POWER SYSTEM 9

Basic Concepts of Voltage Stability Analysis, Small Signal Stability Analysis using Classical Model, Transient Stability Analysis of Multi-Machine Systems, Eigen Analysis of Dynamical Systems, Application of FACTS in Power system stability.

UNIT IV ANALYSIS OF SIMULTANEOUS FAULTS 9

Simultaneous faults, Simultaneous faults by Two – Port Network Theory (Z, Y and H Type Faults), Simultaneous faults by Matrix Transformation, Analytical Simplifications of Series and Shunt Faults.

UNIT V COMPUTER AIDED POWERFLOW ANALYSIS 9

Computer solution to Power flow problems, Solution using Admittance and Impedance Matrix, Comparison of Admittance and Impedance Matrix Techniques, Power-Flow problem, Power flow studies in System Design and Operation, Decoupled Power Flow Method.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- apply the mathematical fundamentals for power flow analysis.
- determine the fault analysis.
- explain the stability analysis in power system.
- analyse and design the Port networks and Matrix transformation.
- determine a computer based solution for power flow problems.

REFERENCES

1. J.J. Grainger and W.D. Stevenson, " Power System Analysis", McGraw Hill, New York,1994.
2. G.L. Kusic, "Computer Aided Power Systems Analysis", Prentice Hall, 1986.
3. I.J. Nagrath and D.P. Kothari, "Modern Power System Analysis", Tata McGraw Hill, 1980.
4. P. Kundur, Power System Stability and Control, McGraw Hill, 1994.

5. J.D. Glover, M. Sarma and T.J. Overbye, Power System Analysis and Design, Fourth Edition, Thomson Engineering Press, 2008.

WEB LINKS

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2. https://www.scribd.com/.../Computer-Aided-Power-Systems-Analysis.
3. http://nptel.ac.in/courses/108107028/5

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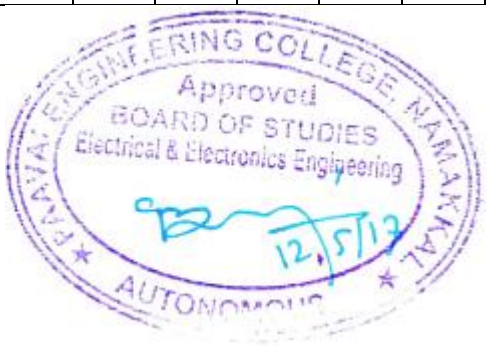


ELECTIVE VI

PPS16651 APPLICATIONS OF MEMS TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

- To design the concepts of new fabrication methods and more reliable MEMS technology.
- To understand the differentiate MEMS sensors and actuator based on electrostatic and thermal principles.
- To infer knowledge on the design of new MEMS device based on various principles.
- To study the design of MEMS devices that works based on various principles.
- To discuss the industrial application of MEMS device.

UNIT I MEMS: MICRO-FABRICATION, MATERIALS AND ELECTROMECHANICALLY CONCEPTS 9

Overview of micro fabrication – Silicon and other material based fabrication processes – Concepts: Conductivity of semiconductors-Crystal planes and orientation-stress and strain-flexural beam bending analysis-torsional deflections-Intrinsic stress- resonant frequency and quality factor.

UNIT II ELECTROSTATIC SENSORS AND ACTUATION 9

Principle, material, design and fabrication of parallel plate capacitors as electrostatic sensors and comb drive - micro motors-actuators-Applications.

UNIT III THERMAL SENSING AND ACTUATION 9

Principle, material, design and fabrication of thermal couples, thermal bimorph sensors, thermal resistor sensors-Applications.

UNIT IV PIEZOELECTRIC SENSING AND ACTUATION 9

Piezoelectric effect-cantilever piezo electric actuator model-properties of piezoelectric materials-Applications

UNIT V CASE STUDIES 9

Piezoresistive sensors, Acceleration sensors, Magnetic actuation, Micro fluidics applications, Medical applications, Optical MEMS.-NEMS Devices Note :Discussions/Exercise/Practice on Workbench : on the basics /device model design aspects of thermal/peizo/resistive sensors etc

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- demonstrate the MEMS technology and MEMS materials.
- explain the different fabrication methods used in MEMS technology and packaging and reliability issues.
- classify the MEMS sensors and actuators working based on electrostatic principles.
- discuss the suitable applications of MEMS sensors and actuators working based on thermal principles.
- design MEMS devices that works based on various principles.

REFERENCES

1. Chang Liu, “Foundations of MEMS”, Pearson International Edition, 2006.
2. Marc Madou , “Fundamentals of microfabrication”,CRC Press, 1997.
3. Boston , “Micromachined Transducers Sourcebook”,WCB McGraw Hill, 1998.

4. M.H.Bao “Micromechanical transducers: Pressure sensors, accelerometers and gyroscopes”, Elsevier, Newyork, 2000.
5. Tai-Ran Hsu, “MEMS and Microsystems Design and Manufacture”, Tata McGraw Hill, 2002.
6. Marc Madou, “Fundamentals of micro fabrication”,CRC Press, 1997.

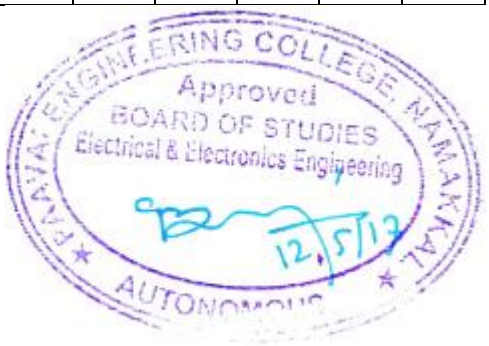
WEB LINKS

1. www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA429659
2. www.engr.uvic.ca/~mech466/MECH466-Lecture-8.pdf
3. www.engr.uvic.ca/~mech466/MECH466-Lecture-6.pdf

CO-PO MAPPING:

Mapping of Course Outcome (CO’s) with Programme Outcomes (PO’s) and Programme Specific Outcomes PSO’s (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	Programme Outcomes PO’s												PSO’s	
CO’s	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	3	-	2	1	-	-	-	-	2	1	2	1
CO2	3	2	3	-	2	1	-	-	-	-	2	1	2	1
CO3	3	2	3	-	2	1	-	-	-	-	2	1	2	1
CO4	3	2	3	-	2	1	-	-	-	-	2	1	2	1
CO5	3	2	3	-	2	1	-	-	-	-	2	1	2	1



PPE16652 VLSI DESIGN TECHNIQUES 3 0 0 3

COURSE OBJECTIVES

- To describe the significance of CMOS technology and fabrication process.
- To understand the importance and architectural features of programmable logic devices.
- To apply the ASIC construction, design algorithms and basic analog VLSI design techniques.
- To explain the concepts of sequential system and floor planning.
- To study the logic synthesis and simulation of digital system using VHDL and Verilog HDL.

UNIT I CMOS DESIGN 9

Overview of digital VLSI design Methodologies- Logic design with CMOS-transmission gate circuits - Pass Transistor - Clocked CMOS-dynamic CMOS circuits, Bi-CMOS circuits- Layout diagram, Stick diagram-IC fabrications – Trends in IC technology.

UNIT II PROGRAMABLE LOGIC DEVICES 12

Programming Techniques-Anti fuse-SRAM-EPROM and EEPROM technology – Re- Programmable Devices Architecture- Function blocks, I/O blocks, Interconnects, Xilinx- XC9500,Cool Runner - XC-4000,XC5200, SPARTAN, Virtex - Altera MAX 7000-Flex 10KStratix.

UNIT III BASIC CONSTRUCTION, PLACEMENT AND ROUTING 6

System partitioning– FPGA partitioning – Partitioning methods – placement physical design flow – global routing – detailed routing – special routing- circuit extraction –DRC.

UNIT IV SEQUENTIAL SYSTEMS AND FLOOR PLANNING 6

Memory cells and Arrays, Clocking disciplines, Design, Power optimization, Design validation and testing.Floorplanning methods, Global Interconnect, Floor Plan Design, Off-chip connections.

UNIT V LOGIC SYNTHESIS AND SIMULATION 12

Overview of digital design with Verilog HDL- hierarchical modeling concepts- modules and port definitions- gate level modeling- data flow modeling- behavioral modeling- task & functions- Verilog and logic synthesis-simulation-Design examples- Ripple carry Adders- Carry Look ahead adders- Multiplier- ALU- Shift Registers, Multiplexer- Comparator- Test Bench.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- understand the basic concepts of CMOS circuits.
- acquire knowledge on architectural features of programmable logic devices.
- understand basic analog VLSI design techniques.
- apply and use the sequential system circuits.
- design and simulate the basic analog and digital circuits using Verilog HDL.

REFERENCES

1. E. Eshranghian, D.A. Pucknell and S. Eshraghian, “Essentials of VLSI circuits and systems”, PHI, 2010.
2. Neil H.E. Weste, David Harris and Ayan Banerjee, “CMOS VLSI Design, A circuits and Systems Perspective”, 2010.

3. W. Wolf, “Modern VLSI Design”, Fourth Edition, Pearson, 2009.
4. S.M. Sze, “VLSI Technology”, McGrawHill,Deluxe Edition, 2010.
5. Douglas Perry, „VHDL Programming By Example“, Tata McGraw Hill, 2007.
6. John P.Uyemura “Introduction to VLSI Circuits and Systems”, John Wiley & Sons, Inc., 2002.

WEB LINKS

1. https://docs.google.com/file/d/0B9LJy8vattSMeWxOMDl1Sk43Sjg/edit
2. etidweb.tamu.edu/.../VHDL%20Programming%20By%20Example%20d.
3. www.csit-sun.pub.ro/courses/vlsi/Modern_VLSI_Design.pdf.

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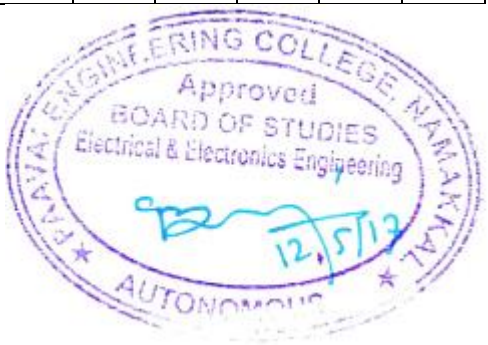

PPE16653 VIRTUAL INSTRUMENTATION SYSTEMS 3 0 0 3

COURSE OBJECTIVES

- To infer knowledge on Virtual instrumentation Architecture.
- To analyze the new concepts on Graphical programming.
- To understand the programming structure for various parameters.
- To discuss the data acquisition and instrument control.
- To use the applications of hardware and software specifications.

UNIT I INTRODUCTION 9

General Functional description of a digital instrument - Block diagram and Architecture of a Virtual Instrument - Physical quantities and Analog interfaces - Hardware and Software – User interfaces - Advantages of Virtual instruments over conventional instruments –Data flow techniques - Architecture of a Virtual instrument and its relation to the operating system.

UNIT II INSTRUMENT INTERFACE 9

Interfacing of external instruments to a PC – RS 232, RS 422, RS 485 and USB Standards – IEEE 488 standard – ISO – OSI model for series bus – Introduction to bus protocols – Interface basis: USB, PCMCIA, VXI, SCXI, PXI etc.

UNIT III PROGRAMMING TECHNIQUE 9

FOR loops, WHILE loop, CASE structure, formula node, Sequence structures – Arrays and Clusters - Array operations - Bundle - Bundle/Unbundle by name, graphs and charts - String and file I/O - High level and Low level file I/O's.

UNIT IV DATA ACQUISTION 9

Installing hardware, installing drivers - Configuring the hardware –Introduction to data acquisition on PC, Sampling fundamentals,Input/Output techniques and buses. ADC, DAC, Digital I/O, counters and timers, DMA,Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements.

UNIT V APPLICATIONS 9

Motion Control: General Applications - Feedback devices, Motor Drives – Machine vision – Instrument Connectivity - GPIB, Serial Communication - General, GPIB Hardware & Software specifications –Real –Time Systems, Embedded controller, OPC, HMI, SCADA software – Development of process database management system.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- discuss the knowledge on Virtual instrumentation Architecture.
- apply the new concepts in Graphical programming.
- understand the programming structure for various parameters.
- summarize the data acquisition and instrument control.
- implement the applications of hardware and software specifications

REFERENCES

1. Lisa K. wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, New Jersey,1997.
2. Gary Johnson, LabVIEW Graphical Programming, Second edition, McGraw Hill, Newyork, 1997.
3. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes, 2000.
4. N.Mathivanan, PC-based Instrumentation: Concepts and Practice, Eastern Economy Edition, PHILearning private Ltd,2007.

WEB LINKS

1. www.ni.com/labview/
2. https://www.ni.com/getting-started/set-up-hardware/
3. www.ni.com/pdf/manuals/370426n.pdf

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